"PHYSICAL AND CHEMICAL ANALYSIS OF DRINKING WATER OF BALH TEHSIL DISTT. MANDI HIMACHAL PRADESH (INDIA)"

SYNOPSIS OF THE THESIS

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DECLARATION

I hereby declare that the ~~dissertation~~ synopsis entitled "Physical and Chemical Analysis of Drinking Water of Balh Tehsil Distt. Mandi Himachal Pradesh (INDIA)" to be submitted for the partial fulfillment of the Degree of Doctor of Philosophy in Chemistry is my original work and the ~~dissertation~~ synopsis has not formed the basis for the award of any degree, diploma, associateship or fellowship of similar other titles. It has not been submitted to any other University or Institution for the award of any degree or diploma.

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Table of Contents

Title **Page No.**

1. **Introduction ……. 1-3**
2. **Literature Review…….4-6**
3. **Aims and Objectives……..6**
4. **Materials and Methodology…….7-10**
5. **Chapter Plan……..11**
6. **List of References……..12-14**

INTRODUCTION

Water is one of the most important and precious natural resources. It is essential of all living organisms from the simplest plants and microorganisms to the most complex living system known as human body. Water a combination of hydrogen and oxygen atoms, with a chemical formula, H_2O is known to be the most abundant compound (71%) on earth surface. It is significant due to its unique physical and chemical properties [1].

Water is very important gift of nature to all living things. A life without water cannot be imagined. Water is vital to our body system. We entirely depend upon water. Water is an important and essential chemical component in our body, comprising 60% of our body weight. Every system of body depends upon water. Its importance is known from human history. In ancient times human settled near river banks or other water sources. Most of the great civilizations depended upon particular source of water e.g. the Egyptian civilization settled on the banks of the river 'Nile' whereas Chinese civilization located on the banks of rivers 'Yellow' and 'Yanzi'. Fresh water is essential for agriculture, industry, power generation, domestic and household purposes. The development of all living things is impossible without good quality and sufficient quantity of water [2]. Water covers 71% of earth's surface in the form of seas, oceans, rivers, wells, lakes, ponds etc. Out of 71% only 3% is fresh water while 97% saline water present in seas and oceans. 2% of fresh water is present in the form of ice in the polar region. Only 1% of water is present in the form of surface and ground water. Water which is used for drinking and for domestic purpose must be highly pure, free from contamination and harmful chemicals. Rivers, wells and bore wells are important sources of water used in our day to day life but nowadays these sources are getting highly polluted through various agencies like industrial effluents, sewage, agriculture, domestic wastages etc. These hazardous chemical wastes are making a series of changes in physico–chemical values of water [3]. Being very important, in ancient times it was put in medicinal and therapeutic use. Nowadays pollution of fresh water resources has become a global problem. The pollution enhances bad taste, colour, odour, turbidity and causes hardness and frothing of water. It also increases the corrosive action of water towards different metals and alloys [4] The use of such kind of water causes many harmful effects on flora and fauna. The composition of surface and ground water depends upon geographical, topographical,

meteorological, hydrological and biological factors. It also varies with seasonal differences in runoff volume, weather and the water level [5]. Ground water is less susceptible to contamination as compared to surface water [6]. Quality of water can be defined in terms of the physical and chemical parameters. It is affected by the various sources of pollution which throw the risks of various health hazards to the public. Therefore it becomes the need of the day to analyse the water quality and hence the purpose of the study. The hygiene, environmental sanitation,storage, distribution, disposal, global awareness and judicious use of water which help in the protection and conservation of water resources are the factors promoting to undertake the research project .

The various sources of water are:

a) Surface water

1) Rain water:- It is the purest form of natural water, since it is obtained as a result of evaporation from surface water. However, during the journey downwards through the atmosphere, it dissolves a considerable amount of gases (CO_2, SO_2, NO_2) and the suspended solid particles. Therefore this water is the purest after its initial showers towards earth .

2) River water :- Rivers are fed by rain and spring waters. Water from these sources flow over the surface of land, dissolves the soluble minerals of the soil and finally falls in rivers. In general , the greater the contact that water has with the soil, the greater is the amount of dissolved impurities in river water. Rain water thus contains dissolved minerals of the soil. River water also contains the organic matter derived from the decomposition of plants and small particles of sand and rock in suspension. Thus river water contains considerable amount of dissolved as well as suspended impurities .

3) Lake water :- This water has a constant chemical composition. It contains much lesser amount of dissolved minerals than any other water, more quantity of organic matter in it .

4) Sea water :- It is the most impure form of natural water. Rivers join sea and throw in the impurities carried by them. Moreover, continuous evaporation of water from the surface of sea makes sea water continuously richer in dissolved

impurities. Sea water contains about 3.5% of dissolved salts, out of which about 2.6 % is sodium chloride. Other salts present are sulphates of sodium, bicarbonates of potassium, magnesium and calcium, bromides of potassium and magnesium and a number of other compounds. Surface water contains suspended matter which often contains the disease-producing bacterias. Hence, this water as such is not considered to be safe for human consumption.

b) Ground water

A part of the rain water, which reaches the surface of the earth, percolates into the earth. As this water advances its journey downwards, it comes in contact with a number of mineral salts present in the soil and dissolves some of them. Water continues its downwards journey, till it meets a hard rock, when it retreads upwards and may come out in the form of 'spring water'. Spring and Well waters are cleaner in appearance due to the filtering action of the soil, but contain more of the dissolved salts. Thus these waters contain more hardness. Usually the ground water contains the least quantity of the dissolved organic matter.

LITERATURE REVIEW

Water is the elixir of life. It is the major constituent of all living bodies. For example, water makes up approximately two-thirds of the human body weight [7] .About 780 million people do not have access to clean and safe water and about 2.5 billion people do not have proper sanitation. Around 4 million people die each year due to water related diseases and disasters [8]. The consequences of drinking unsafe, contaminated water are numerous and are still not fully understood. According to the World Health Organization (WHO), drinking contaminated water

is one of the major causes of diarrheal diseases; which make up the second leading cause of child mortality, resulting in the death of about 760,000 children aged below 5 years annually. For this

reason, the WHO has identified the lack of access to clean drinking water as the most critical factor that negatively influences the general health and well-being of populations in developing countries [9].Overall, the provision of safe drinking water can help to reduce or eliminate preventable deaths (emanating from water-borne diseases) and improve the quality of life for low-income households around the world [10]. Access to safe drinking water and sanitation is a global concern. Water quality and suitability for use are determined by its taste, colour, odour, turbidity and concentrations of organic and inorganic matters [11]. Contaminants in the water can affect its quality and consequently the human health. These contaminants are further categorized as inorganic and organic matters, radionuclides, disinfectants and microorganisms [12]. Generally the inorganic chemicals hold a greater portion as contaminants in drinking water in comparison to organic chemicals [13].The inorganic ions Ca^{2+} , Mg^{2+}, Na^{+}, K^{+}, Cl^{-}, F^{-}, NO_2^{-}, NO_3^{-}, SO_4^{2-}, HCO_3^{-} , CO_3^{2-} are commonly present in water and responsible for its salinity as compared to other ions **[**14**].** Contaminants in water with heavy metals is a serious problem all over the world [15] **.**

Keeping in view the literature review attempts have been made to study maximum parameters of the drinking water. Acceptable quality of drinking water depends upon physical and chemical parameters [16].They make the water unsuitable for drinking, agriculture, industrial and laundry purposes.

Tremendous work has been carried out in analyzing physico-chemical parameters of different drinking water sources in India and abroad.

- Premlata Vikal [17] studied various parameters of quality of drinking water of Pichhola

  Lake in Udaipur, Rajasthan. The values of conductivity, COD and sulphate ion crossed the standard values in water samples and found unfit for drinking purpose.
- Manjare *et al*.[18] studied various physico-chemical parameters of Tamadalge water tank in District Kolhapur, Maharastra. The results revealed that all the parameters were within recommended limits with slight fluctuations yet water was safe for domestic and irrigation purposes.
- Saravana Kumar and Ranjith Kumar [19] studied quality of ground water of Ambattur industrial area in Chennai city, TamilNadu. Results revealed that the water was highly contaminated and not safe for human health.
- Basawaraja Simpi *et al*. [20] studied various physico-chemical parameters of Hoshalli water tank in District Shimoga, Karnataka at regular intervals of time. The results revealed that water was not contaminated and the parameters were within permissible limits. It could be used for irrigation and domestic purposes.
- Aryal *et al*. [21] studied various physico-chemical parameters from various sources in District Myadgi, Nepal. Values were compared with WHO standards and found the Coliform contamination problem with drinking water.
- Sreenivasa Salla and Suparna Ghosh [22] assesed the water quality parameters of Lower Lake, Bhopal (M.P). The studies revealed that water is contaminated and not safe for drinking purpose. D.O. level was very low whereas TDS and TSS were high in concentrations .
- Rahmanian *et al*. [23] studied various physico-chemical parameters of drinking water in state of Perak, Malaysia. Results revealed that all the parameters were within recommended values of WHO. Concentrations of heavy metals were below the standard maximum limits, thus water safe for drinking purpose.
- Amanial Haile Reda [24] studied various Physico-chemical parameters of drinking water of Arbaminch Town, Ethiopia and compared with drinking water quality standard values given by WHO. The concentration of F^- is below permissible limit having no harmful effect on consumers.

- Meride and Ayenew [25] studied various physical,chemical and biological parameters of drinking water of Wondogenet campus, Ethiopia. The values were within permissible limits of WHO.

AIMS AND OBJECTIVES

As the water affects the health of the public in different ways, hence the study of quality of drinking water is important. Balh Tehsil (Nerchowk and surrounding area) has become the hot point for setting up of business establishments, educational institutions and industries because of its moderate climate and strategic location. The continuously growing population is putting additional pressure on the water resources and threatening the quality of water. So the present study has been planned to analyse the quality of drinking water in Balh Tehsil. Balh Tehsil of District Mandi (H.P) is supplied drinking water from different sources. The sources of drinking water are

(i) I.PH supply (Govt. supply)

(ii) Ground water supply (Hand pump and Spring waters)

The present study has the following objectives-

1) Survey of drinking water sources and identification of water related problems faced by the public in Tehsil Balh of District Mandi (H.P).

2) Collection of samples from different water sources and study the quality of drinking water seasonally, yearly and comparison with National and WHO quality standards.

3) To spread awareness among the public regarding quality of water, drinking water regulations and the potential health risks associated with the use of contaminated water.

MATERIALS AND METHODOLOGY

Safe and clean drinking water is basic need for health and also right of human beings [26]**.** Water is essential for the survival of life. On an average a human being consumes about two litres of water everyday during his whole life period. The water pollution by various sources has become a major concern for the welfare of mankind. Therefore the quality of water has to be analysed. For this purpose we have selected the following water sampling stations.

1. Kanaid
2. Rati
3. Bhangrotu
4. Nerchowk
5. Lohara

Tehsil Balh of District Mandi (H.P) is a beautiful valley across the Baggi Canal originated from Pandoh Dam. This valley is located at an elevation of 800m above sea level in Shivallik Hills. The valley stretches from Gutkar in north to Sundernagar in south,Baggi in east to Gumma in west

The study will be carried out by collecting samples of drinking water throughout the year seasonally. Samples will be collected from five sampling stations for the analysis of quality of drinking water decided by Colour, Odour, Temperature, Turbidity, TDS, TSS, TH, Alkalinity, Conductivity, pH, Aluminium, Copper, Zinc, Iron, Lead, Manganese, Arsenic, Cadmium, Chromium, Silver, Fluoride, Nitrite, Nitrate, Sulphate, Phosphate, DO, BOD, COD.

Sampling station are selected keeping in view of the objectives of the analysis of drinking water. They are decided after the field investigation. A portion of water which is small enough in volume to be transported conveniently and handled in the laboratory (1Litre) still representing the characteristics of the water available in the water source is selected as the water sample. Such a sample is collected at a particular time and place and will represent the composition of the source at that time and place. The sampling bottles are made of plastic

(polyethylene) tightly sealed by cap. The bottles are soaked with 10%HCl for 24 hours and then thoroughly cleaned with Chromic acid mixture ($K_2Cr_2O_7$ + conc. H_2SO_4) and rinsed with distilled water. Before the collection of sample the bottle is rinsed two times with the sample of water. Sample at 20cm depth in the source of water is collected. Sample bottles are transported to the laboratory using the transport box. Methods and techniques of data collection, their analysis will be carried out as per the Standard Methods devised by American Public Health Association (APHA) 2012.

List of parameters and their experimental methods

S.No.	Parameter	Experimental Method
1	Color	Spectrophotometric Method
2	Odour	Threshold Odour Number Method
3	Temperature	Thermometry
4	Turbidity	Nephelometric Method
5	TDS	Gravimetric Method
6	TSS	Filtration Method
7	Total Hardness	EDTA Method
8	Alkalinity	Titrimetric Method
9	Conductivity	Conductivitymetric Method
10	pH	Electronic Method
11	Aluminium	Atomic Absorption Spectrophotometric Method
12	Copper	Atomic Absorption Spectrophotometric Method
13	Zinc	Atomic Absorption Spectrophotometric Method
14	Iron	Atomic Absorption Spectrophotometric Method
15	Lead	Atomic Absorption Spectrophotometric Method
16	Manganese	Atomic Absorption Spectrophotometric Method
17	Arsenic	Atomic Absorption Spectrophotometric Method
18	Cadmium	Atomic Absorption Spectrophotometric Method
19	Chromium	Atomic Absorption Spectrophotometric Method
20	Silver	Atomic Absorption Spectrophotometric Method
21	Fluoride	Colorimetric Method
22	Nitrite	Colorimetric Method
23	Nitrate	Colorimetric Method
24	Sulphate	Gravimetric Method
25	Phosphate	Colorimetric Method
26	DO	Winkler's Method
27	BOD	Titrimetric Method
28	COD	Reflux digestion Method

RELEVANCE AND NEED OF THE PRESENT STUDY

Water is very essential for the existence of all kinds of life on this earth . But as a result of activities of human beings the surface as well as ground water is adversely affected. The quality of water is the most important characteristic of water .This quality is affected by the different sources of pollution which include sewage discharge , Industrial discharge , agricultural discharge including pesticides and fertilizers and the urban runoff. The quality of water is also affected by the lack of awareness among the people . The awareness of the judicious use of water , hygiene,environmental sanitation and storage are the points to maintain the quality of water resources. This awareness has compelled the human being for the installation of various government programmes to protect and conserve the water resources . Water quality monitoring is one of such government programmes at the national, state , district ,block and panchayat levels. The National Rural Drinking Water Programme is Government programme and a component of Bharat Nirman with the objective of providing safe and clean drinking water through hand pumps and I.P.H. piped water supply to all the rural and urban areas. Government has taken lot of efforts but still poor water quality has posed enormous health risk due to irregular monitoring of water supply systems. It is estimated that around thirty eight million Indians are affected by water borne diseases annually. About 1.5 million children are estimated to die of diarrhoea every year due to the contaminated water. As per the estimation of World Health Organisation out of ten million annual deaths in India, about eight lakhs are due to the lack of safe drinking water supply,effective sewage system, sanitary facilities and hygienic conditions. Therefore, water quality issue is of high concern.

In Balh Tehsil the ground water is highly polluted which is mostly by the sewage waste(household waste) and agricultural waste including pollution by pesticides and fertilizers being used on large scale for the crop production. However , Balh Tehsil is not an industrial area but a few small scale industries and workshops are there and the discharge of waste from these sources contains organic waste and toxic metals. Keeping in view the water quality issue being of high concern and the inadequate monitoring by the Government agencies the present study is selected.

Despite a lot of work carried out for assessing the quality of water in terms of physico-chemical parameters of various places in India yet no systematic study is

carried out for the analysis of physico-chemical parameters and hence quality of water of Balh Tehsil,District Mandi,H.P. Therefore,the present work needs to be undertaken.

Water being a universal solvent and renewable resource make it vulnerable to get polluted, Drinking water should be clear ,colorless, odorless with agreeable taste and free from contamination. The importance of ground water resources used for drinking purpose requires not only the water management but also a regular and careful monitoring of its quality.

In the present study, the basic and important physical and chemical parameters of drinking water will be viewed with the special identification of the problem parameters and then the remedial measures will be suggested to improve the existing unhygienic conditions of water supplies of Balh Tehsil. It is planned to assess the water quality parameters at five sites of Balh Tehsil , Mandi,H.P. as (1) Kanaid (2) Rati (3) Bhangrotu (4) Nerchowk (5) Lohara

CHAPTER PLAN

Chapter-I:-Introduction

This chapter will include introduction on the importance of water in our life. It also includes the different sources of water.

Chapter-II:-Literature Review

As the work is focused on the study of quality parameters of water, a comprehensive literature survey on quality parameters of water will be presented in this chapter. Aims and objectives of the presented work will be highlighted at the end of this chapter.

Chapter-III:-Materials and Methodology

This chapter will include materials and methodology being used for the determination of quality parameters of water as per APHA-2012.

Chapter-IV:-Results and Discussion

This chapter will include the results drawn from the various investigations in the research work.

Chapter-V:-Conclusions

This chapter will include the conclusions drawn from the research work. Based on the results some future scopes will also be identified.

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